

THE NETWORK NEWSSTAND

Brian Hayes

The object you hold in your hands has three centuries of tradition behind it as a medium of communication in the sciences. Journals and magazines have been the favored place for reporting scientific results ever since the *Journal des Savants* first appeared in 1665. But printed periodicals will not remain the scientist's medium of choice for another three centuries, or even another three decades. Their future beyond the next three years is somewhat cloudy. Already, much of the day-to-day discourse of science flows over computer networks, and dozens of electronically distributed journals have sprung up. Sooner or later, ink on paper will be superfluous.

The new schemes of electronic publication have an irresistible appeal. Information is delivered in minutes instead of days or weeks. It comes right to your desk, day or night, whether the library is open or not. Computer-based methods of searching and indexing make it easier to find what you want. Perhaps most important, electronic documents can include more than just text and static images; they can be enriched with large data sets, sounds, video clips, animations or simulations. In the right computing environment they could become *active* documents, which invite the reader to participate as well as to peruse; for example, a reader might select an equation and immediately see it solved or graphed.

Electronic publications also have some notable disadvantages. People who do their reading in bed or at the beach find it awkward to drag a network connection along with them. Computer displays cannot yet match the resolution of high-quality printing, so that typographical niceties are lost. There are subtler losses, too, including even olfactory and tactile aspects of the experience of reading. Furthermore, the promise of active documents has so far been forestalled by incompatibilities among computer systems, with the result that many electronic publications stick to the lowest common denominator of plain text.

My guess is that most of the impediments will soon be overcome by the advance of technology. Computers will be standardized, portable, lighter

than an average book, with wireless links to a universal network. But I also think the most interesting questions about the coming of electronic journals and magazines are not technical questions. They are economic and institutional questions. Who will pay? Who will own? These are the issues that will determine whether the new medium brings an improvement in scholarly communication or just a new set of problems.

Capturing Keystrokes

Publishing has already been transformed by the computer. Manuscripts are no longer typed and retyped by author, editor and compositor; the author's own keystrokes are captured in a computer file. The handling of illustrations has changed in a similar way. Graphs and diagrams are drawn on the computer; photographs are scanned and digitized. The pages of *American Scientist* are assembled almost entirely as computer files, which are output onto photographic film ready for the manufacture of printing plates.

It is easy to imagine a further step in the evolution of ink-and-paper publishing. The time will come when the printing press will be a computer peripheral device not much different from what the laser printer is today. When an issue is ready for the press, the editor will select a "Print..." item from a menu, and the magazine will enter a queue of jobs awaiting time on the presses.

But why stop there? If you can print a magazine with the click of a mouse, you can just as easily send it directly to its readers over the network. In the publishing industry today, a complex infrastructure stands between the writer and the reader. There are editors and subeditors, proofreaders, illustrators, designers, prepress service bureaus, color separators, strippers and platemakers, printers and binders, truckers, mailers, jobbers, customs expeditors, catalogue agents, and much else. In principle the new technology could sweep all of this structure away. Information would flow from the author's computer directly to the reader's computer.

Electronic Titles

Network publishing is already happening. Here are a few of the publications available to anyone with Internet access. *Psycoloquy* is a refereed jour-

Brian Hayes, a former editor of *American Scientist*, has been writing about computing for 10 years. Address: 211 Dacian Avenue, Durham, NC 27701. Internet: hayes@concert.net.

nal that publishes "brief reports of ideas and findings on which the author wishes to solicit rapid peer feedback...in all areas of psychology and its related fields." *Flora Online* is a "peer-reviewed electronic journal for systematic botany." *Solstice: An Electronic Journal of Geography and Mathematics* is "an online, refereed journal published... twice yearly, on the astronomical solstices." *The Ulam Quarterly* defines its scope as all areas of science and mathematics that were of interest to Stanislaw Ulam. *Postmodern Culture*, "an electronic journal of interdisciplinary studies," aims to "encourage reconsideration of the forms and practices of academic writing, and to experiment with departures from the traditional idea of published texts as immutable and monologic." *EJournal* is "a peer-reviewed, academic periodical interested in theory and praxis surrounding the creation, transmission, storage, interpretation, alteration and replication of electronic text." The quotations in the above descriptions are from a "Directory of Electronic Journals and Newsletters" compiled by Michael Strangelove of the University of Ottawa (and distributed, of course, over the network). The latest edition lists 137 journals, magazines, newsletters and other periodicals.

Most electronic journals have been launched by individuals or small groups, but some of the learned societies are also experimenting with making their publications available over the network. The American Chemical Society has been a pioneer in this respect: 20 ACS journals have been available on-line since 1984, albeit only through paid-access databases. The American Association for the Advancement of Science is publishing the *Online Journal of Current Clinical Trials* on a paid-subscription basis. The American Psychological Association sponsors *Psycology*. The American Mathematical Society has made its *Bulletin* available through an Internet service called e-math. In Britain the Institution of Electrical Engineers is publishing a network version of *Electronics Letters*.

Commercial publishers are also testing the waters. Oxford University Press is the publisher of *Postmodern Culture*. Gordon and Breach offers a printed edition of *The Ulam Quarterly*. *The Scientist*, a newspaper published by the Institute for Scientific Information, now has a free Internet version, and so does the magazine *Mother Jones*.

The most ambitious project now getting under way is the *Chicago Journal of Theoretical Computer Science*, a new on-line journal expected to begin publication this spring. The journal will be edited by Stuart Kurtz, Michael O'Donnell and Janos Simon of the University of Chicago, but the publisher will be the MIT Press, which will handle marketing and distribution.

Free Words!

The economic argument in favor of electronic publishing has been articulated most clearly in the case of scholarly journals, particularly the specialized ones with a small circulation. Au-

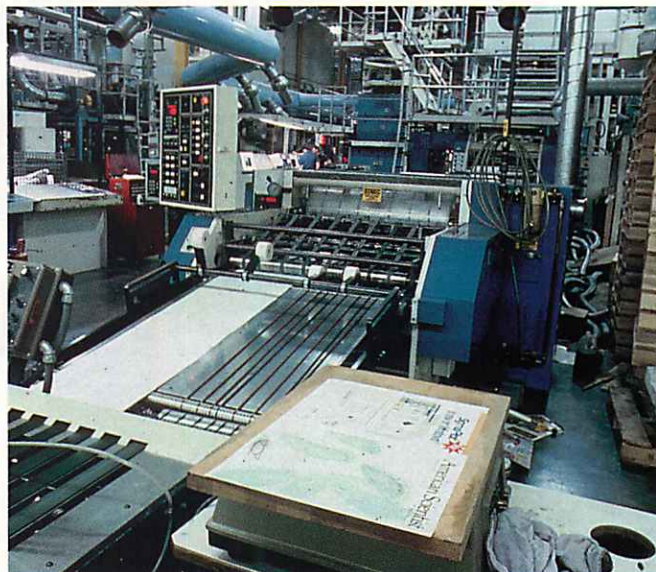


Figure 1. Paper publishing: An issue of *American Scientist* comes off the press. (Photograph by David Schoonmaker.)

thors of papers in such journals are not paid for their contributions; on the contrary, they may be asked to remit page charges to the publisher. The editors and referees who select the articles are also usually volunteers from the academic world. In recent years the volunteer community has even been doing the typographic formatting of most papers. Then the same authors, editors and referees pay hundreds of dollars per volume to buy back the fruit of their labor from the publisher. The final irony is that none of the insiders actually read the journal. By the time the printed version of a paper appears—often years after it was written—workers within the discipline have long since read it in preprint form. (Even people on the periphery of the field do not read the journal; they send post cards to the authors, requesting reprints.)

Those who see an injustice in this situation urge scholars and their universities to reclaim ownership of their work. Through network technology, they could produce their own journals, bypassing the publishers who, in this view, live as parasites on the scholarly enterprise. The volunteer authors, editors and referees would continue to work much as they always have. But instead of charging libraries and other subscribers hundreds or thousands of dollars for the journal, the editors would send it free to all who have an interest.

This vision of freely flowing scientific discourse may seem dreamy and utopian, but a number of electronic journals are already operating on just such a basis. In Strangelove's list of 137 publications, only three impose a charge on readers. Of course, 137 journals amount to only a minuscule fraction of the publishing industry, but when most journals are distributed electronically, the economics of publishing will surely be transformed.

One possible endpoint of the evolution toward network distribution of scholarly writing is sim-

Figure 1. Electronic publishing: Chemistry journals are displayed on a computer screen in the CORE electronic library project at Cornell University. (Photograph courtesy of Michael E. Lesk, Bell Communications Research.)

ply that publishing ceases to be an economic activity. Information is no longer bought and sold—at least in the academic world—but flows without barriers from creator to consumer. Any costs of publication are paid indirectly, as other costs of doing research are already paid. After all, the Internet itself has long been supported on this basis, as a part of the infrastructure. Why not devise a publishing economy that works the same way?

It is worth noting that giving away a publication is quite different from selling it cheaply; there is a discontinuity when the price falls to zero. With free distribution, there is no need to collect fees (which in itself saves much cost) and more important there is no need to defend property rights. A publisher can encourage readers to share, rather than prosecute them for copyright infringement. The Internet community has a strong tradition of sharing. For example, when several people from the same university subscribe to a network mailing list, the recommended practice is to enter a single subscription and make multiple copies locally. This arrangement is a convenience to the publisher of a free journal, but it is a horrifying prospect to anyone trying to make a living from subscription fees.

Making It Pay

Free distribution may well be the answer for some network periodicals, but there is also much publishing that simply will not happen without

monetary rewards. At this point I must confess a personal interest. For two decades I have made my living as a writer and editor for scientific periodicals, and I can't quite imagine how my work would have been supported if those periodicals did not earn revenue for their publishers. And it is not only profit-making enterprises that rely on such income; many non-profit societies derive much of their support from publishing activities.

The most obvious economic model for network publishing is the one that now dominates print publishing: the familiar practice of selling annual subscriptions. You send the publisher a check, and in return you receive a year's worth of issues by electronic mail. Several variations on this scheme could be considered. Issues might be sold individually, as they are on a newsstand. Or perhaps the fundamental unit of exchange should be even smaller: the individual article rather than the entire issue.

All such pay-as-you-go arrangements have a worrisome feature in common: They come into conflict with that generous spirit of sharing that is so much a part of network culture. Publishers already have occasional skirmishes over the "fair use" of Xerox machines. In a world of densely connected networks, the problem will be far worse. Digital information can be copied instantly, effortlessly and perfectly at near-zero cost. The copying can be made automatic, so that when one subscriber receives a journal, his or her colleagues

get it seconds later. Furthermore, in a fully networked environment, copying isn't even necessary. Over a high-bandwidth network link you can read your colleague's journals as easily as your own, without making a copy. Thus publishers would need to regulate not only the copying of their works, as they currently do, but also reading over your neighbor's shoulder.

The problem of sharing is made worse by an unfavorable feedback relation. As more readers share a subscription rather than buy their own, the publisher must charge more per subscription in order to maintain the same revenue stream. Rising prices, however, increase the incentive for sharing. In the limiting case the entire cost of publication is paid by one subscriber, who then shares with all other readers.

I take a reasonably benevolent view of my own species, and I tend to believe that people will do the right thing if it isn't terribly inconvenient. As I see it, the real problem in this situation is not that some people will violate rules forbidding the sharing of network publications; the real problem is that some people will abide by such rules. Sharing, after all, is supposed to be a good thing. It is one of those fine kindergarten virtues that ought to be cultivated rather than suppressed. In the world of science, in particular, the free exchange of ideas is much celebrated. It seems a shame to adopt an economic system that requires people to act contrary not only to their own selfish interests but also contrary to public good. There ought to be a better way.

In 1991 the economic consequences of electronic publishing were considered in depth at a meeting convened in Monterey by a group called the Coalition for Networked Information. Many of the ideas discussed at the meeting were subsequently presented in a special issue of the journal *Serials Review* (Grycz 1992), along with other views on the same topic. Here are some of the alternatives considered.

The music industry offers one model. Broadcasters pay royalties to songwriters, but without attempting to keep track of each time a song is played. Instead, radio stations contribute to a fund that is allocated according to the estimated air time received by each composer's works. On the network, fees collected from all readers could be distributed among publishers based on estimates of each periodical's total circulation or readership. Plans of this kind have the important advantage that the reader pays the same fee no matter what he or she chooses to read and whether copies are obtained from the publisher, from a library or from a colleague. On the other hand, the publisher's compensation is based entirely on quantity, not quality. In effect, all magazines and journals are sold at the same price, which makes it much more attractive to be publishing *People* than *Physical Review*.

The world of broadcasting is also the source of another economic model. Peter Young of the Na-

tional Commission on Libraries and Information Science has proposed forming a Corporation for Scholarly Publishing, analogous to the Corporation for Public Broadcasting. Just as the CPB fosters television programming that might not be commercially viable, the CSP would subsidize publications judged to be in the public interest.

Serials Review is a journal of library science, and several of the papers in the special issue focus on the role of the library in the distribution of electronic information. In one proposal a library would buy a "site license" allowing it to make published materials available to a community of scholars. In effect, the libraries would become regional distributors or wholesalers for the publishers.

Another mechanism for financing electronic publications is not mentioned by the *Serials Review* authors, nor have I seen it discussed elsewhere. Many print publications are supported partly or wholly by the sale of advertising space; perhaps the same idea could be made to work in the network world. Internet veterans will cringe at the very thought of ads on the network, which remains one of the last refuges in modern life still free of commercial speech. But as a means of sustenance advertising has a key advantage: It gives publishers an incentive to encourage the widest possible dissemination of their work. And advertising itself has a legitimate economic function: Just as scientists need a forum in which to announce their new results, companies need a place to announce and sell their products.

Competing for Readers

Many discussions of network publishing start with the premise that the dominant cost in conventional publishing is the cost of manufacturing and shipping the physical artifact: paper, ink, printing, postage. It follows that if you eliminate all these things at a stroke, the cost of publication must become very small. I am skeptical of this assumption. To explain why, I find it most convenient to look at publishing from the point of view of the author.

If you have a paper ready for publication, why submit it to a journal? Why not just photocopy the manuscript and send it around? The journal may well offer better and cheaper reproduction, but I think few publishing decisions are made on that basis. Malcolm Getz of Vanderbilt University points out three benefits a journal offers an author (Getz 1991): The author's work is disseminated to a wide audience; it is archived (by libraries) so that it will be available to future readers; and its selection by editors or peer reviewers certifies its quality. These three benefits are really facets of a single benefit: What the journal is offering is readers, now and in the future. You publish in a journal because people subscribe to it, because they save it and because they read it. And thus the critical task for a journal is not to deliver paper and ink to its readers but to deliver readers to its authors.

For mass-market magazines—where readers must be delivered to advertisers as well as to authors—the competition for readers is plainly visible. A gauge of its importance is that magazine publishers are willing to pay not only \$10 million sweepstakes prizes but also the much larger costs of mailing out sweepstakes entry forms to almost every household in the U.S. In the world of scholarly publishing the imperative to find readers is just as powerful but manifests itself in a different way. Economies of scale in printing would seem to favor the consolidation of journals into fewer titles, each with larger circulation. In fact the trend is in the opposite direction: Publishers have been introducing ever more specialized and narrowly defined journals, each with a smaller audience. One reason is that such an audience is easier to identify and reach, making a marketing effort more efficient.

How will the shift to electronic distribution change the economics of reader acquisition? No one knows, because no one has any extensive experience with circulation promotion over the network. Electronic junk mail may be even less welcome than the paper kind, in which case publishers may have to find some wholly new way to solicit subscriptions. Or the search for readers may be more efficient on the network, since the

cost of sending mail is so much less. When your \$10-million sweepstakes offer arrives by electronic mail, will you be more or less likely to respond? Lower costs should lead to lower prices, which should make the job of persuading buyers easier. On the other hand, as Michael O'Donnell has pointed out (O'Donnell 1993), the attention of readers is a finite resource. If all magazine and journals were totally free and instantly available, how many more would you read than you read now?

Bibliography

- Amiran, Eyal, and John Unsworth. 1991. *Postmodern Culture: Publishing in the electronic medium. Public-Access Computer Systems Review* 2(1):67-76.
- Borman, Stu. 1993. Advances in electronic publishing herald changes for scientists. *Chemical and Engineering News* 71 (24):10-24.
- Getz, Malcolm. 1992. Electronic publishing: An economic view. In Grycz 1992, pp. 25-31.
- Grycz, Czeslaw Jan (ed.). 1992. *Economic Models for Networked Information. Serials Review* 18(1-2).
- Lesk, Michael. 1992. Pricing electronic information. In Grycz 1992, pp. 38-40.
- O'Donnell, Michael J. 1993. Electronic journals: scholarly invariants in a changing medium. University of Chicago Department of Computer Science Technical Report 92-07. Available from librarian@cs.uchicago.edu.
- Strangelove, Michael. 1992. Directory of electronic journals and newsletters. Edition 2.1. E-print, available from list-serv@acadvm1.uottawa.ca.

EXPERIMENTAL DATA-FITTING

SCIENTIST establishes a new category of software dedicated entirely to fitting model equations to experimental data. It is the only data fitting program on the PC that will fit any combination of user-defined algebraic and differential equations, implicit, multivariate, linear and non-linear equations. Model equations can be used for data fitting and/or exploratory simulation. Try software developed from the "ground up" to provide the data-fitting results you need.

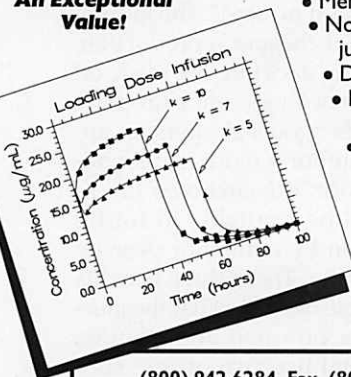
Now Only
\$295

An Exceptional
Value!

SCIENTIST™

- Menu driven/window oriented
- No programming language - just enter model equations
- Double precision accuracy
- Enter models quickly with dialog boxes/templates
- Import and export plots and data to/from other programs
- Facilitates your gov't "Paperless" submission needs

**60 Day Money Back
GUARANTEE!**



(800) 942-6284 Fax (801) 943-0299

MICROMATH®
PO Box 21550 • SLC, UT 84121

Avoid the Two Perils of Data Analysis

Missed effects and lack of fit occur when one fails to appreciate the properties of data or fits inappropriate mathematical and statistical models to data. Now a new book, *Visualizing Data* by William S. Cleveland, author of the standard reference, *The Elements of Graphing Data*, has visualization tools that help avoid these perils. *Visualizing Data* probes the philosophy of learning from data, and shows the relationship between visualization and classical methods of data analysis.

HOBART PRESS

Four Ways to Order:

1. Electronic Mail: books@hobart.com
2. Fax:
U.S. & Canada: 800-258-2236, Other Countries: 908-522-0171
3. Telephone Voice Mail:
U.S. & Canada: 800-258-2235, Other Countries: 908-273-5208
4. Postal Service: Hobart Press, Box 1473, Summit, NJ 07902-8473
Send name and address with credit card no. and expiration date (Visa, MC or AmEx) or a check in U.S. dollars on a U.S. bank, or a purchase order.

Price: US\$40.00 plus shipping

Shipping Charges: United States: US\$3.50 for first book, US\$0.50 for each additional. Canada: US\$6.00 per book (includes GST). Other Countries: US\$9.00 per book